DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

WASHINGTON

HGB:AER

Technical News Bulletin No. 39.

July 7, 1920.

GENERAL NOTE.

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

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1 Investigation of Zirconium and Other Special Steels

An extensive micrographic examination of specimens of various alloy steels for certain special use has been completed. The results of this investigation show that zirconium, titanium, and aluminum may all be placed in the same class. They are not true alloying elements but act merely as scavengers and when they are not eliminated in the slag they are present in the steel as inclusions. In small amounts, they may help to produce soundness in the steel but otherwise they cannot do much good and may even be detrimental.

2 Properties of Boiler Plate at Elevated Temperatures

Previous work on this subject has been mentioned in other numbers of the Bulletin. Considerable progress has been made during the past month and it is expected that experiments to determine the effect of the rate of loading on proportional limit will be completed during July. Results so far obtained show interesting changes above and below a "blue heat" but sufficient check runs have not been carried out to warrant a statement at the present time. Low temperature annealing of blue-worked plate does not produce as decided an increase in proportional

limit when the annealing is carried out in the blue range as does cold rolling.

3 Investigation of Bearing Metals

Compressive tests at 25°, 50°, 75° and 100°C have been made on five different compositions of babbitt metal, four of which correspond to the proposed specifications of the Society of Automotive Engineers. The data thus secured will be used in preparing the final specifications of the above society. Other lines of work now in progress include a determination of the best pouring temperature and the effect of aging on the properties of bearing metals, and a study of the micro-mechanism of failure.

4 Conference on Enameled Metals at the Bureau of Standards

Work on this subject has been mentioned in preceding numbers of the Bulletin. Studies of the expansion of various enamels have shown that the contraction curves of the cryolite enamels follow the cooling curves of the steel and iron quite closely, and these enamels are found to fish scale the least, as might be expected. Enamels high in boric acid which fish scale decidedly, have a cooling curve very different from that of the steel. It has been found also that annealing from 500°C to room temperature has resulted in eliminating the tendency to fish scale. It was noted also that certain steels did not cause fish scaling under any conditions while others did. It was found that in five steels fish scaling increased with increase of copper but there seemed to be no relation between this defect and the crystalline constituents of the steel.

5 Work in Connection with the Testing of Railroad Track and Other Scales

During the past month, the Bureau's testing Equipment No. 1 operated in the state of Pennsylvania testing 11 railroad-owned scales and 5 industry scales, while Equipment No. 2 operated in the states of Tennessee, Kentucky, and Indiana and tested 16 railroad-owned scales and 1 master scale. Equipment No. 3 completed work on 13 railroad-owned scales in the states of Illinois and Missouri. Besides this regular work, the personnel detailed to Equipment No. 1 have done a considerable amount of work at the Philadelphia Navy Yard during the past two months which may be summed up as follows:

2 Railroad track scales; 2 shop track scales; 3 crane scales; 26 platform scales under 500 lb. capacity; 23 platform scales ranging in capacity from

500 to 2,000 lb.; 15 platform scales over 2,000 lb. capacity; 3 furnace charging scales; 1 weightometer; 2 wagon scales; 1 Scott tensile machine, 1 - 100,000 lb. capacity seaplane scale, beside the testing of 34 weights.

Representatives of the Bureau of Standards held a conference with the members of the Track and Hopper Scale Department of the State of Minnesota at which detailed plans were discussed for carrying out tests on grain hopper scales in connection with an investigation of this subject. A tentative selection of the elevators and scales which are to be tested was made and other details were arranged.

At a meeting of the Committee on Yards and Terminals of the Railway Association and American Railway Engineering Association, which met in Chicago, a representative of the Bureau assisted by serving on this committee. Plans for the current year's work were outlined and the Bureau accepted positions on two sub-committees, one the committee on railroad track scales, and the other a committee on indexing technical and scientific literature with particular reference to the interests of the Committee on Yards and Terminals.

A representative of the Bureau was asked to join in an examination of the grain-handling facilities of the new Pennsylvania elevator in Baltimore. This is of interest in connection with the introduction of specifications covering the construction and use of scales and also the related subject of handling grain in an expeditious and proper manner.

6 Investigation of Contraction and Expansion of Cement Mortar

An attempt has been made to effect a combination using a local mix that would not show unfavorable volumetric changes when cast in a dry absorptive form. Such a combination seems to have been obtained by using one part of this local mix with 6 parts of gravel screenings. The difference between this and other combinations is that the present one results in a harsh mix rather than a salvy or sticky one since 1:1 or 1:2 mortars, which are salvy or sticky, are inclined to show unfavorable volumetric changes. Results suggest that a harsh, initially inadhesive mix is more likely to be susceptible to influences for reducing volumetric change than any other type of mixture.

7 Investigation of the Fineness of Cement Particles

Microscopic measurements were made in 1915 on the maximum sized particles passing the 200-mesh sieve and were reported in Bureau of Standards Technologic Paper No. 47. Since the adoption of the standard screen scale for sieves, it is desired to make a careful determination of the size of separation by the 200-mesh sieve. Based on this separation, the air analyzer will be calibrated so that its separations will be in series with the new standard screen scale and supplementary to it, since the separations made by the air analyzer will be smaller than can now be obtained by means of a sieve. The present measurements of the Bureau give slightly larger results than were obtained in 1915 and further studies are planned to determine the cause of this variation.

8 Production of Optical Glass at the Bureau of Standards

The experimental optical glass plant of the Bureau of Standards has turned out quite a large amount of glass during the past month. Molding was done on every working day from May 20 to May 31, and from June 14 to June 19, inclusive. The interruption was due to the installation of glass pressure regulators. Approximately 1,200 rectangular slabs weighing about 650 lb. were molded. During the week of June 1 to June 5, 2 melts of optical glass were made, of which one melt was a borosilicate crown and the other a light crown, both with an index of 1.52. These melts were successful, the glass apparently being of very good quality.

9 Recent Chemical Publications

Two articles on chemical work have been published this month. The first of these entitled "The Determination of Zirconium in Steel" appeared in the Journal of Industrial and Engineering Chemistry, Volume 12, page 562. The paper presents a critical review of published and theoretical methods for the determination of zirconium in steel and gives a method for the determination of silicon, aluminum, titanium, and zirconium in steel containing other probable or possible alloying elements, such as tungsten, chromium, vanadium, phosphorus, molybdenum, copper, nickel cobalt, uranium, and cerium.

The second paper "A Weight Burette" for gas analysis will be found in the Journal of the American Chemical Society, Volume 42, page 1177. In this paper is described an apparatus for conveniently

determining small quantities of gas by weighing the confining liquid which is displaced. The percentage accuracy of the apparatus is shown to be comparable with the general accuracy of good titrometric measurements.

10 Research on Electron Tubes as Radio Detectors

The currents which electric waves produce in radio receiving apparatus are extremely small and alternate at very high frequencies. Because of the rapid reversals and the feebleness of these currents, they cannot be detected by ordinary electric-current indicating instruments, and special apparatus must be provided for this purpose. This is usually designed to convert these currents into a form which can be detected with a sensitive galvanometer or telephone receiver.

One device for this purpose is the electron tube, sometimes called an audion, which has entirely replaced the crystal detector formerly used. There is a need for exact knowledge of the properties and behavior of electron tubes, in order to secure such designs as will work most effectively in a particular circuit. Methods of measurement have been devised and an investigation carried out at the Bureau, as a result of which the mode of action of these tubes as detectors has become more definitely known. A special form of electric measuring bridge has been constructed, by means of which the four coefficients upon which the action of the tube depends are easily measured.

Information on this and other work on electron tubes is included in a treatise on the subject which is now in preparation.

11 Determination of the Acidity and Alkalinity of Sugars

Through the Bureau's efforts, a further step in the classification of the refined sugars of commerce has been brought to completion. As a result of this work, it is possible to express in absolute terms the acidities or alkalinities of various samples of sugar. While the actual magnitudes of the alkaline or acid substances amount to but a few ten-thousandths of one percent (expressed in terms of lime), the variations in the quantities of these substances probably exert fundamental influences on the properties of the sugars when used for certain manufacturing processes. Although at this stage of the

investigation, it is impossible to predict what all the results will be, it seems likely that an intimate relation exists between the reaction (acidity or alkalinity) and the "strength" of the sugar. "Strength" is a term used by candy manufacturers to designate the behavior of sugar when boiled at a high temperature. The exact definition of this term and its correlation with other properties must await further study.

The method of measuring the "reaction" of sugars is an application of a method developed elsewhere for use in physiological chemistry. A number of indicators (organic substances which are extremely sensitive to the reaction of a liquid) have been developed and their colors related exactly to the reactions in question. Two different indicators were used. The method was found to be very reliable and reproducible. Some sugars were found to be acid in reaction, many were approximately neutral, and some alkaline.

Those sugars which were found to be acid or alkaline were titrated to neutrality and the quantity of reagent necessary to produce neutralization was carefully measured. Many samples having the same acidity required very different quantities of reagent to produce neutrality. This fact shows great variations in the nature of the impurities and probably indicates the presence of "buffer" substances, i.e., substances which resist a change in reaction.

Respectfully,

S. W. STRATTON

Director
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